04P04353

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N° 21,714 A.D. 1899

Date of Application, 31st Oct., 1899
Complete Specification Left, 31st July, 1900—Accepted, 27th Oct., 1900

PROVISIONAL SPECIFICATION.

An Apparatus for Detecting Explosive Gas or Dust in the Atmosphere.

I, CHARLES EDWARD GLASCODINE SIMONS, The Hollies, Merthyr Tydfil, Glamorganshire, Physician & Surgeon & Consulting Chemist, do hereby declare the nature of this invention to be as follows:—

A substance possessing catalytic properties is introduced into the mixture suspected to contain explosive hydrocarbon gases or explosive dust. I prefer to use spongy platinum and find that it acts best when it is heated. When a substance of this nature is introduced into the suspected atmosphere and if explosive gas or dust be present two phenomena occur (A) Moisture is formed by the combustion of the gas if it contain hydrogen, this moisture I condense on a bright surface so that it can be observed and the quantity of moisture that is formed is taken as an index of the amount of hydrogen present in combined or uncombined forms in the atmosphere. (B). The temperature of the spongy platinum rises and I measure this rise of temperature with a suitable thermometric apparatus. The rise of temperature is proportionate to the amount of hydrogen and hydrocarbon gas that may be present. To detect explosive dust apart from explosive gases containing hydrogen and carbon, in a mixture of air gas and dust I first filter a quantity of the mixture through cotton wool or other suitable filtering media, to free it from dust, and read the temperature of the dust free mixture after it passes the spongy platinum; then the mixture of the three substances is allowed to flow through the apparatus and if a further increase in temperature is now indicated by the thermometric apparatus hereafter called the thermometer it is due to the decomposition of the dust and its subsequent combustion. My apparatus contains a suitable heating appliance such as a coil of wire heated by an electric current or a tube maintained at a sufficient degree of heat; the mixture of gas air and dust flows through this chamber. The spongy platinum is so placed that it is also heated by the same means and the mixture is allowed to pass over and around it. The thermometer is placed near the spongy platinum, so as to be heated by it, the surface of the thermometer may be bright, and used to condense moisture upon; the whole of the heating appliance and the spongy platinum and the thermometer may be enclosed in a suitable chamber and the scale or the registering portion of the thermometer may project from the said chamber for convenience of obversation. Guards of wire gauze may be placed at the inlet and the outlet of the said chamber to prevent any possibility of an explosion of gas or dust within the said chamber reaching the outside atmosphere. I also make the appliance automatic in its action. This is done by means of (A). An electric alarm thermometer arranged so that when the mercury in this instrument reaches a determined temperature it shall complete an electric circuit which may be made to ring a bell or give a suitable alarm; or (B). The properties of a metallic wire which is heated are made use of in the following manner. When a metallic wire is heated it offers a resistance to the passage of an electric current which increases with the rise of temperature in definite proportional ratio. If I pass

[*Price 8d.*]

an electric current hereafter called circuit 1, through a wire for the purpose of heating the platinum sponge and I place this sponge so that any heat derived from it heats the aforesaid wire, this further increase of heat increases the electrical resistance of the wire. If the circuit 1, contains in it a solenoid or coil or an electromagnetic apparatus which is made to support a lever weighted at one end and which is so balanced that the current is just sufficient to prevent the said lever from falling and if the increased resistance be introduced into this circuit, the electromagnetic appliance will no longer be able to support the whole weight of this lever. On this lever falling it makes contact with a conductor and this contact is arranged so as to close an electric circuit called hereafter circuit 2, which may contain an annunciator bell or suitable appliance for the purpose of directing attention to the closure of circuit 2. This appliance also automatically indicates the failure of current in circuit 1, and directs attention to the apparatus being out of order by failure of current in circuit 1.

Dated this 30th day of November 1899.

Signed C. E. G. SIMONS,
The Hollies, Merthyr Tydfil.

COMPLETE SPECIFICATION.

An Apparatus for Detecting Explosive Gas or Dust in the Atmosphere.

I, CHARLES EDWARD GLASCODINE SIMONS, The Hollies, Merthyr Tydfil, Physician & Surgeon & Consulting Chemist, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

A substance having suitable catalytic properties heated to a suitable temperature is brought into contact with the atmosphere suspected to contain explosive dust or gases. If either or both of the above mentioned substances are present, an increase of temperature takes place in the catalytic reagent, and products of combustion are formed. Platinum wire, I have found to be a suitable catalytic reagent, and I here describe methods of constructing apparatus which I have found to be convenient for the above purposes. A form of apparatus illustrated in Fig. 1, Sheet 1, is constructed as follows.—A coil of platinum wire of sufficient thickness is enclosed in a chamber communicating with the atmosphere through wire gauze screens "G." In Fig. 1, Sheet 1, "A," represents the coil of platinum wire, "F," "F," is the chamber, and "G," "G," are the wire gauze screens. This cord "A," is heated to a sufficient degree of temperature by the current from the battery or generator "C." The current from "C," passes first to a Wheatstone's bridge composed of the metal strips of low resistance "L^1," "L^2," "L^3," "L^4," arranged as shewn in Fig. "1," Sheet "1," and the high resistance wire "K," with the sliding contact piece "Y," making contact with "L^4," and "Z." The small circles represent the contact terminals to which the leads "B," "B," and the galvanometer leads "*b*," "*b*," and the resistance "E," are attached. When the current from "A," is traced, it will starting from the left hand side of "C," be found to pass to the contact piece "Y," thence from each side of "Y," along "Z," through "A," and "E," to the small circle on "L^2"; and thence back to the right hand side of "C." The amount of current on each side will be proportional to the difference in the resistance between "A," and "E." The resistance "E," is made equal to "A," when "A," is heated by its share of the current from "C," but if the temperature of "A," rises from any cause, more current will be passed

through "E," and therefore the potential at the two points at which the wires "*b*," "*b*," are fixed on "L^1," and "L^2," will no longer be equal, so the galvanometer "D," will shew a deflection. By sliding "Y," in the direction of the greater resistance this difference of current can be equalised, and the distance that "Y" is moved gives the difference between the resistances of "A" and "E." This is indicated by the galvanometer coming back to its zero point. I graduate the scale "K," in the following manner.—I first arrange "A," and "E," so that when current is passed through them as in Fig. 1, Sheet 1, the indicator of "D," stands at zero, when "Y," is at the zero point in the scale "K." Then a mixture of air and coal gas containing one *per cent.* of gas is passed through "F," and the amount of the deflection of "D," is noted, and "Y," is slidden along "K," sufficiently to bring the indicator of "D," to zero again. This gives the point 1% on the scale of the instrument when graduated. Further graduations are obtained in like manner for the other graduations of the scale. Instead of the galvanometer "D," I make use sometimes of a telephone placed in circuit "*b*," "*b*," and when the telephone gives a loud sound on closing circuit "*b*," "*b*," by means of a key it is taken as evidence that the resistances "E," & "A," are unequal. By sliding "Y," in the direction of the greater resistance the sound will get fainter & will at length disappear. The point of equal resistance can by this means be determined with great delicacy. Instead of the resistance coil "E," in some forms of apparatus especially those used in collieries it will be more convenient to use an incandescent electric lamp of known resistance. This apparatus may be made in a portable and a fixed form. When portable the parts are assembled together in or on a suitable case for "C." When made in a fixed form "A," may be placed anywhere where the presence of explosive gas or dust is suspected; and "C," may be placed in any convenient place for the production of electric energy, whilst "D," and the Wheatstone's bridge may be placed in any position suitable for observation. Thus "A," might be placed in the airway of a colliery, whilst "C"; and "D," and the Wheatstone's bridge might respectively be in the engine house and the offices. In this case the only precautions that must be of necessity taken, are that the whole resistance of the leads from the Wheatstone's bridge to "A," must be allowed for when during the calibration of the instrument "E," is balanced against "A."

A second form of apparatus may be constructed as shewn in Fig. 2, Sheet 2. I find however that the use of spongy platinum as mentioned in my Provisional Specification is not absolutely necessary, as a heated coil of platinum wire has sufficient catalytic properties, and simplifies the construction of the apparatus. A current hereafter called circuit 1 is made to traverse a coil of platinum wire "A," enclosed in a chamber "F," "F," which is in communication with the atmosphere through the wire gauze screens "G," "G." The current in circuit 1, also passes through a solenoid or electromagnet "H" "H"; "*h*," "*h*," of which "H," "H," are the coils and "*h*," "*h*," are the soft iron cores. In Fig. 2, Sheet 2, "*e*," "*e*," are metal brackets supporting "Y," and "S"; and "*f*," "*f*," are the contact terminal screws carrying the current to "*e*," "*e*." "S," is an adjustable contact screw making contact sometimes with "Y"; "W," is an adjustable weight to counterbalance "Y," and the magnetic pull on "Y," when "A," is unaltered in resistance by external sources of heat. The connecting piece between "Y," and "W," is pivoted beneath the contact screw shewn by the small circle on the right hand bracket "*e*," and thus "Y," is allowed to make contact with "S," or to rest against the stop "*s*," as shewn in the figure. "C" is the source of electricity, and "B," "B," the leads conveying current from "C." A casing "*d*," is shewn for enclosing "C," and acting as a support for parts of the apparatus. The circuit "2" I arrange to start at a battery "*c*," and to flow to the alarm "M," thence to the screw "S," and thence to "Y," when "S," and "Y," are in contact. From the other side of the battery it flows to "Y," so that when "S," and "Y," are not in contact the circuit is open and not complete. When the current in circuit 1, diminishes from any cause, whether from increase in the resistance

of "A," or the failure of output in "C," the circuit "2" will be closed as the pull of "H," "H," "*h*," "*h*," on "Y," will not longer be able to maintain "Y," in the position shewn in Fig. 2, Sheet 2, and "Y," "S," will come in contact and the bell or alarm "M," will ring. This apparatus may be fixed or portable. When portable it is assembled in a convenient manner as aforesaid with regard to the apparatus described in Fig. 1, Sheet 1. When it is fixed the various parts may be distributed as is found convenient. A form of apparatus using a mercurial thermometer for the thermometric device is shewn in Fig. 3, Sheet 3. "A," is the coil of platinum wire, "B," "B," are the leads for the electric current from "C," the source of electricity, "F," "F," is the chamber communicating through the wire gauze screens "G," "G," with the atmosphere, and which contains the coil "A," and the mercurial thermometer "H." "S," is a wire which passes through the open end of "H," as shewn in the figure and which may be adjusted at any desired position in the central tube of "H," so as to make contact with the mercury in "H," at any desired point. The coil "A," surrounds the bulb of "H," and when heated will cause the mercury in the narrow portion of the tube to rise in the usual way. A second electric circuit which is kept open until "H," registers the temperature determined upon when arranging the apparatus, is completed as follows.—From the battery "*c*," the current flows to the alarm "M," and thence to "S." When "S," is not in contact with the mercury in "H," it is interrupted at the end of "S," by the space "1." From the other side of the battery it flows to the end of "H," where it terminates in a wire which is melted into the glass of "H," so as to make contact between the mercury inside "H," and the lead "*b*." When "A" increases in temperature owing to any outside cause, "H," indicates the increase of temperature. When the temperature reaches the pre-arranged limit the space "1," is occupied by the mercury in "H," expanding and contact is made with "S," and "M," therefore rings owing to the circuit "*b*," "*b*," being completed. This apparatus may be fixed or portable as aforesaid with regard to the previously described apparatus. In the use of all the above apparatus dust and gas may be differentiated by filtering the air that is to be tested through cotton wool or other filtering medium, which will retain the dust & prevent its passing into the chamber containing the catalytic reagent. The apparatus will then register the amount of explosive gas that may be present. The air containing both the gas and the dust is next allowed to pass into the chamber containing the catalytic reagent, & the apparatus then indicates the amount of the mixed explosive substances present. By deducting the amount of the gas that is already found to be present the amount of the explosive dust will be indicated. If the apparatus indicates that no gas is present, the amount of the dust can be found directly, as the indication of the instrument will be due to dust alone. In all forms of the apparatus the first sign of gas being present is the deposition of moisture on cool surfaces placed near "A." In all forms of the apparatus spongy platinum may be enclosed in the coil "A"; which for this purpose requires to be made longer. This increases the heat produced by the apparatus. Any catalytic reagent that can be drawn into wire may be used in this apparatus, even if it is a nonconductor of electricity, as all that is necessary to do with it is to place it so that its rise in temperature reacts on a thermometric device.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

(1). A means of detecting the presence of explosive gases by the changes of temperature they cause in a catalytic reagent.

(2). A means of detecting explosive dust by the changes of temperature that it causes in a catalytic reagent.

(3). An apparatus for automatically signalling the presence of the presence of

explosive gas or explosive dust, or both explosive gas & explosive dust in the atmosphere when either exceed a determined limit.

(4). An apparatus as described above for the purpose of detecting explosive gases or explosive dust in the atmosphere the apparatus to work automatically.

Dated this 20th day of October 1900.

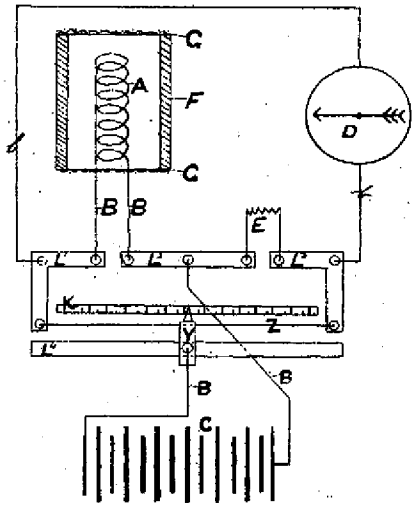
C. E. G. SIMONS.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1900.

A.D. 1896. Oct. 31. N° 31,714.
SIMONS' Condenser Regenerator.

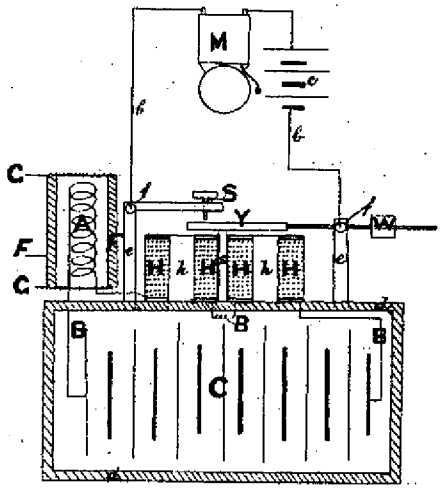
SHEET 1

FIG. 1.



SHEET 2

FIG. 2.



[This drawing is a reproduction of the original on a reduced scale.]

FIG. 1.

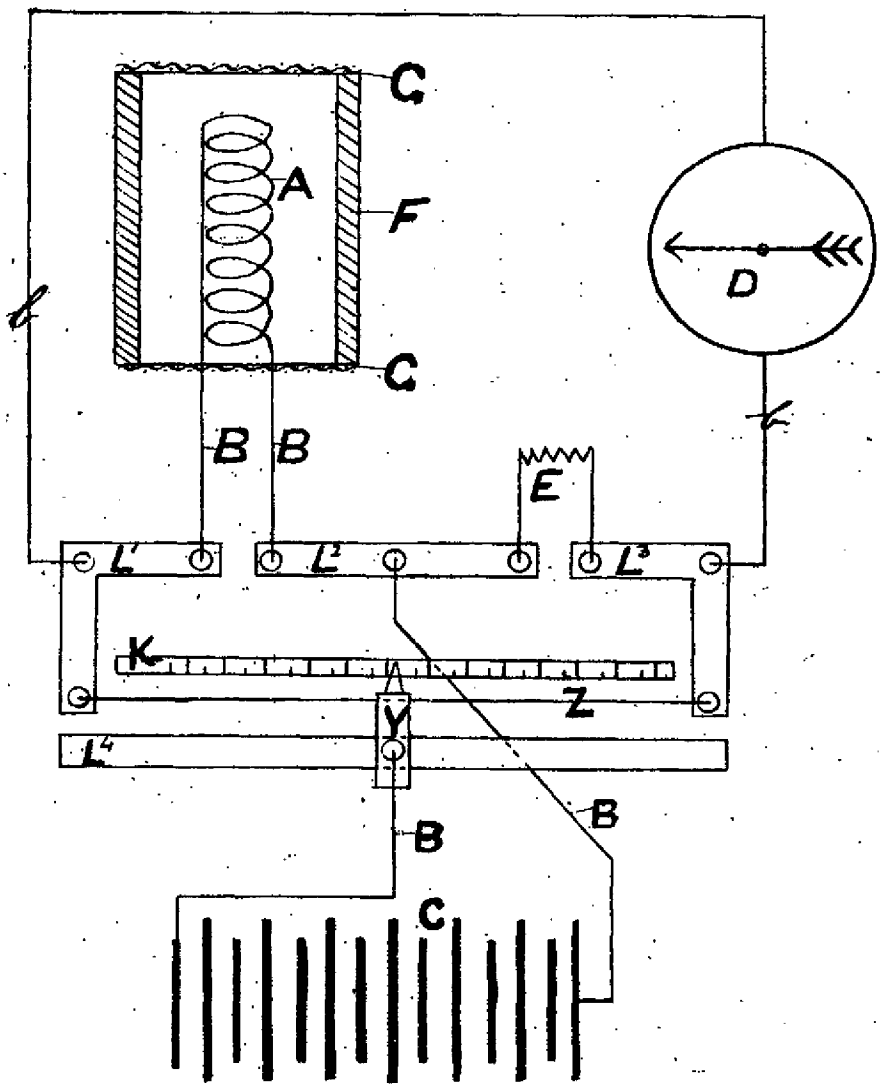
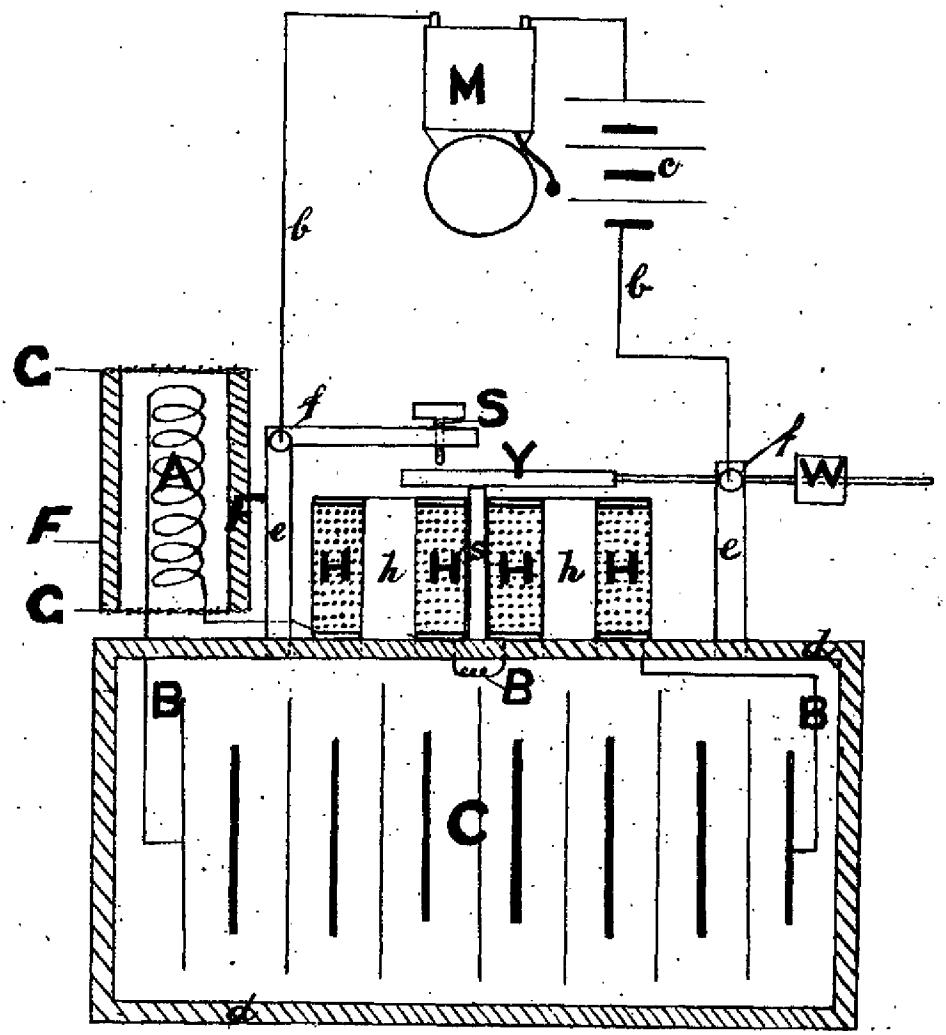


FIG. 2.



Malby&Sons, Photo-Lith

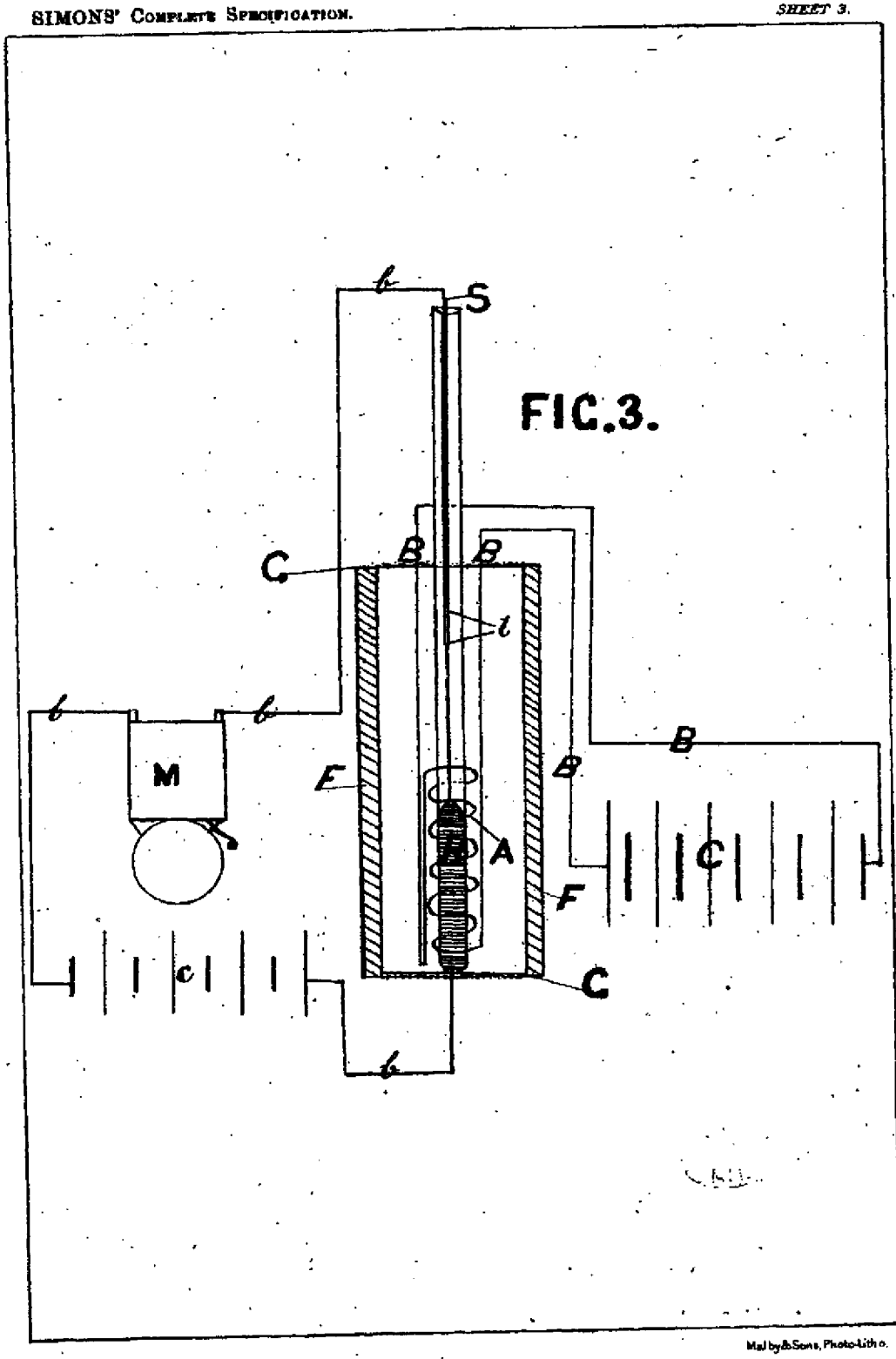


FIG. 3.

[This Drawing is a reproduction of the Original on a reduced scale.]

Malby&Sons, Photo-Litho.